National Institute for Commodity Promotion Research & Evaluation

AUGUST 1995
NICPRE 95-02
R.B. 95-04

Impact of Generic Fluid Milk Advertising on Whole, Lowfat, and Skim Milk Demand

by
Harry M. Kaiser
and
J. Carlos Roberte

Department of Agricultural, Resource, and Managerial Economics
College of Agriculture and Life Sciences
Cornell University, Ithaca, New York 14853

The National Institute For Commodity Promotion Research And Evaluation

The National Institute for Commodity Promotion Research and Evaluation was initially funded by a CSRS Special Grant in April 1994. The Institute is an offshoot of The Committee on Commodity Promotion Research (NEC63). A component of the Land Grant committee structure to coordinate research in agriculture and related fields, NEC63 was established in 1985 to foster quality research and dialogue on the economics of commodity promotion.

The Institute's mission is to enhance the overall understanding of economic and policy issues associated with commodity promotion programs. An understanding of these issues is crucial to ensuring continued authorization for domestic checkoff programs and to fund export promotion programs. The Institute supports specific research projects and facilitates collaboration among administrators and researchers in government, universities, and commodity promotion organizations. Through its sponsored research and compilations of related research reports, the Institute serves as a centralized source of knowledge and information about commodity promotion economics.

The Institute is housed in the Department of Agricultural, Resource, and Managerial Economics at Cornell University in Ithaca, New York as a component of the Cornell Program on Commodity Promotion Research.

Institute Objectives

- Support, coordinate, and conduct studies to identify key economic relationships and assess the impact of domestic and export commodity promotion programs on farmers, consumers, and the food industry.
- Develop and maintain comprehensive data bases relating to commodity promotion research and evaluation.
- Facilitate the coordination of multi-commodity and multi-country research and evaluation efforts.
- Enhance both public and private policy maker's understanding of the economics of commodity promotion programs.
- Facilitate the development of new theory and research methodology.

Table of Contents

Abstract

The purpose of this study was to determine whether there is a statistical difference in sales responsiveness to advertising among whole, lowfat, and skim milk consumers. A case study for New York City which used monthly time series demand data from 1986 through 1992 is presented. Separate per capita demand functions were estimated for whole, lowfat, and skim milk when per capita generic fluid milk advertising expenditure was used as one of the explanatory variables. Other explanatory variables of per capita sales included retail prices of whole, lowfat, and skim milk, retail price of orange juice, per capita income, and a health index representing consumer concerns about fat in one's diet.

Long run sales responsiveness to generic milk advertising were found to be 0.14, 0.17, and 0.08 for whole, lowfat, ad skim milk, respectively. These are higher than previous estimates for generic fluid milk advertising in New York City. The sales responsiveness was found to be statistically significant at the 10% level for whole and lowfat milk, but not significant for skim milk. It was concluded that generic fluid milk advertising, as currently structured, has had a positive and significant impact on whole and lowfat milk demand, but little or no impact on skim milk demand in the New York City market. It should be noted that current generic milk advertising practice does not distinguish among the three products.

The results suggest that the current message of the fluid milk advertising campaign in New York City is explicitly influencing actual and potential whole and lowfat milk drinkers rather than skim milk consumers. Therefore, it can be concluded that under campaigns that do not differentiate among the three main fluid milk products, it would be better to target actual or potential consumers of whole and lowfat milk rather than skim milk drinkers in New York City. It is clear that any attempt to influence skim milk demand would require a change in the current message. In addidtion, since the sales responsiveness to advertising among the three products are found to be different, future research should study the separate impact of generic fluid milk advertising on each fluid milk product. It would be useful to apply this analytical approach to other markets to determine whether similar conclusions might hold, or whether the New York City market is unique in its response to generic fluid milk advertising.

Preface

Harry M. Kaiser is an Associate Professor in the Department of Agricultural, Resource, and Managerial Economics at Cornell University, and Co-Director of the National Institute for Commodity Promotion Research and Evaluation (NICPRE). J. Carlos Roberte is a Research Associate in the Department of Agricultural, Resource, and Managerial Economics at Cornell Unviersity. The authors thank Valerie Johnson for her thorough editing and layout of this bulletin. The authors would also like to thank Olan Forker and Donald Liu for their helpful comments on an earlier draft of this paper.

This is the second research bulletin published by NICPRE. The mission of NICPRE is to enhance the overall understanding of economic and policy issues associated with commodity promotion programs. An understanding of these issues is crucial to ensuring continued authorization for domestic checkoff programs and to fund export promotion programs. The bulletin will help program managers consider the impacts of various allocation strategies used for promoting different milk and dairy products. Future NICPRE research bulletins will look at similar topics regarding other agricultural commodities.

Introduction

Dairy farmers invest over $200 million annually in programs designed to increase demand for fluid milk and dairy products. These funds are collected by assessing all farmers 15 cents per hundred pounds on milk marketed in the continental United States. Most of this investment is devoted to generic advertising of milk and dairy products. Because of the significant investment of money by producers, there have been numerous studies on the effectiveness of generic milk advertising over the last 20 years. For instance, Forker and Kinnucan summarized the results of 47 studies of generic dairy advertising programs throughout the world. Of these studies, the majority (27 studies) have focused on generic fluid advertising since fluid advertising represents the largest share of advertising expenditures.

The impacts of generic fluid milk advertising have been studied in a variety of geographic locations in the United States. Several studies have examined the impact of generic advertising on milk consumption in New York City (Thompson and Eiler; Kinnucan, 1986; Liu and Forker, 1988, 1990), in Buffalo, New York (Kinnucan, 1987), and Rochester, New York (Thompson, 1979). There have also been investigations of advertising impacts of California (Thompson, 1974), of 12 federal milk marketing orders in the United States (U.S. Department of Agriculture), and at the national level (Ward and Dixon; Liu et al.). While the magnitude of impacts have differed, all of these studies have found that generic advertising has increased consumption of fluid milk above levels it would have been without advertising.

A common characteristic of all previous studies of generic fluid milk advertising has been the aggregation of fluid milk products into a single product. Since consumption patterns for some fluid products have been quite different, aggregation of fluid milk into one product results in a loss of useful information on specific fluid milk product demand characteristics. For example, per capita whole milk (3.5% fat content) has steadily declined for decades, while per capita consumption of lowfat (1% and 2% fat content) and skim milk has consistently increased over time (see Figures 1, 2, and 3). Because of these differing trends, it would be useful to determine whether whole, lowfat, and skim milk drinkers respond differently to the specific existing fluid milk advertising strategy.

Accordingly, the purpose of this study was to determine whether there is a statistical difference in per capita sales response to generic fluid milk advertising among whole, lowfat, and skim milk consumers. A case study is presented for New York City using monthly time series demand data from 1986 through 1992. Separate demand functions are estimated for whole, lowfat, and skim milk that include generic fluid milk advertising expenditures as an independent variable in each equation. The policy implications of the statistical results are then discussed. This analysis provides information to help in fluid milk targeting and allocation decisions. Generally, targeting the group with the largest sales responsiveness to advertising will increase combined sales of fluid milk products.

The Model and Data

Following Liu and Forker (1988), generic advertising was modeled as an extension of the consumer good characteristics model by Lancaster.[1] In this model, advertising may increase demand because it provides consumers information on important attributes embodied in the product. If advertising reduces informational search costs, the net result is a decrease in the implicit price of the product characteristics, which should increase consumption. Consequently, generic advertising variables were included in the demand functions for milk in addition to traditional demand variables, e.g., own price, substitute prices, income, etc.

The demand for each fluid milk product was modeled in double-logarithmic form as follows:

$$\text{(1)} \quad \ln Q_{it} = \alpha + \sum_{k=1}^{3} \beta_{ki} \ln P_{kt} + \beta_{4i} \ln POJ_t + \beta_{5i} \ln INC_t + \sum_{j=0}^{J} \varphi_{t-ji} \ln H_{t-j} + \sum_{s=1}^{3} \pi_{si} QD_s + \sum_{j=0}^{L} \gamma_{t-ji} \ln A_{t-j} + u_{it},$$

where subscript i = 1, 2, and 3 is for whole, lowfat, and skim milk, respectively, and t = 1,..., 84 (monthly data from January 1986 through December 1992). The dependent variable in equation (1) was per capita sales of the ith milk product in period t for the New York City Metropolitan area. The independent variables included the retail price of each of the three fluid products,[2] retail price of orange juice (POJ_t), disposable per capita income (INC_t), a health index (H_{t-j}) measuring the level of public concern about dietary fat in period t-j, seasonal intercept dummy variables (QD_s, where s = 1, 2, and 3 for the first, second, and third quarters, respectively), per capita generic advertising expenditures (A_{t-j}), and u_{it}, an error term with zero mean and variance s_i^2.

For each fluid product, the retail price of the other two fluid products and the retail price of orange juice were used to capture the impact of substitutes on demand, while disposable per capita income was included to measure the effect of income on demand. All prices and income variables were deflated.[3] The

[1]See Liu and Forker (1988) for a more detailed discussion of extending Lancaster's consumer good characteristics model to advertising.

[2]Since 1% and 2% milk were aggregated to represent lowfat products in the model, the retail prices for each product were aggregated by taking a weighted average of the two prices, where the weights are equal to the relative market shares of each product.

[3]Specifically, the whole, lowfat, and skim milk price in the whole milk and skim milk demand functions were deflated by the dairy product price index for New York City. For the lowfat demand equation, these prices were deflated by the food and beverage price index for New York City. The retail price of orange juice was deflated by the food and beverage price index for New York City. Finally, per capita income was deflated by the consumer price index for all items for New York City.

retail price of orange juice used was that of the Northeast region of the United States. The health concern index, which was constructed by Ward based on a sample of consumers, gave the percent of consumers expressing strong or moderate concern about fat in their diets. This variable was included because consumer concern about fat is expected to be an important factor causing the decline in whole milk consumption, and the increase in lowfat and skim milk consumption. Since consumers' past concerns about fat affect current consumption patterns, the health concern index included current as well as lagged values. Quarterly intercept dummy variables were included to capture the impact of seasonality on demand.

To measure the impact of generic advertising on the demand, monthly per capita generic fluid advertising expenditures were included for each fluid milk product. Expenditures were deflated by the media price index to adjust for inflation. Since generic fluid milk advertising has not been found to be product specific (e.g., whole or skim milk), the same level of milk advertising expenditures in the whole, lowfat, and skim milk demand equations were included. Current and lagged values of this variable were included because it is well known that there are carryover effects of advertising on demand. Including current and lagged values of advertising is consistent with the majority of past studies (e.g., Ward and Dixon, Liu and Forker (1988), Liu et al., Kaiser et al.).

Estimation Procedures

Figures 1 to 4 show that sales of whole milk and advertising expenditures have trended downward over the sample period, while sales of lowfat and skim milk trended upward. This suggests that these variables may be nonstationary. Inferences based on standard asymptotic theory may be misleading when data exhibit nonstationary behavior (Davidson and MacKinnon). The relationship between two variables that exhibit a trend may appear to be significant when in fact the only thing they have in common is the trend. This phenomenon is referred to as "spurious regression" in the econometrics literature.

Two methods are commonly used to correct for this problem (Banerjee et al.) : (1) de-trending and (2) differencing the nonstationary series as many times as needed to make them stationary. The appropriateness of each method depends on the form of the data generating process (DGP) for the series under consideration, say y_t. De-trending y_t will be appropriate if the DGP for the series is given by:

$$(2) \qquad y_t = \alpha_0 + \alpha_1 T_t + \varepsilon_t,$$

where T_t is a time trend, ε_t, is white noise, and α_0 and α_1 are parameters. But if the DGP for y_t is given by:

$$(3) \qquad y_t = \alpha_0 + \sum_{i=1}^{l} y_{t-i} + \varepsilon_t,$$

then y_t should be differenced.

As discussed extensively in Banerjee et al. and Davidson and MacKinnon, a unit root test can be used to choose between de-trending and differencing. One of these tests is the "augmented Dickey-Fuller" test (ADFT) for unit roots. The ADFT is based on the following regression equation:

$$(4) \qquad \Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 T_t + \sum_{i=1}^{l} \delta_i \Delta y_{t-i} + \varepsilon_t,$$

where Δ is the first-difference operator, α_0, α_1, α_2, and δ_i are parameters, and ε_t is white noise. The test statistic for the ADFT, say τ, is the t-ratio for the null hypothesis that $\alpha_1=0$. However, τ does not follow a t-distribution. Critical values for t are provided in Fuller. The null hypothesis that y_t has a unit root (i.e., y_t is nonstationary) can be rejected if the calculated value of τ is smaller than the critical value corresponding to the selected significance level. In such a case, y_t must be differenced in order to achieve stationarity.

The ADFT was applied to all continuous variables in (1) using the COINT command in Shazam version 7.0. The lag length l in (4) was set automatically by the Shazam routine. For all the series, the null hypothesis of nonstationarity could not be rejected at the 5% significance level. Based on this result, all variables were differenced once to make them stationary. Since the first difference of the log of the retail whole milk and skim milk prices were also found to be nonstationary, these variables were differenced twice.

The lag weights φ_{t-ji} and γ_{t-ji} in (1) were approximated using third and second degree polynomials, respectively. In addition, end point restrictions were imposed on the distribution of the γ_{t-ji} coefficients. The lag length for both generic advertising expenditures and the health index was originally set to 12 months. The lag length in the final model specification for each variable was then determined sequentially using the following procedures. First, the number of lags for advertising expenditures was reduced until the t-test for the significance of the last lag coefficient could reject the null hypothesis of being equal

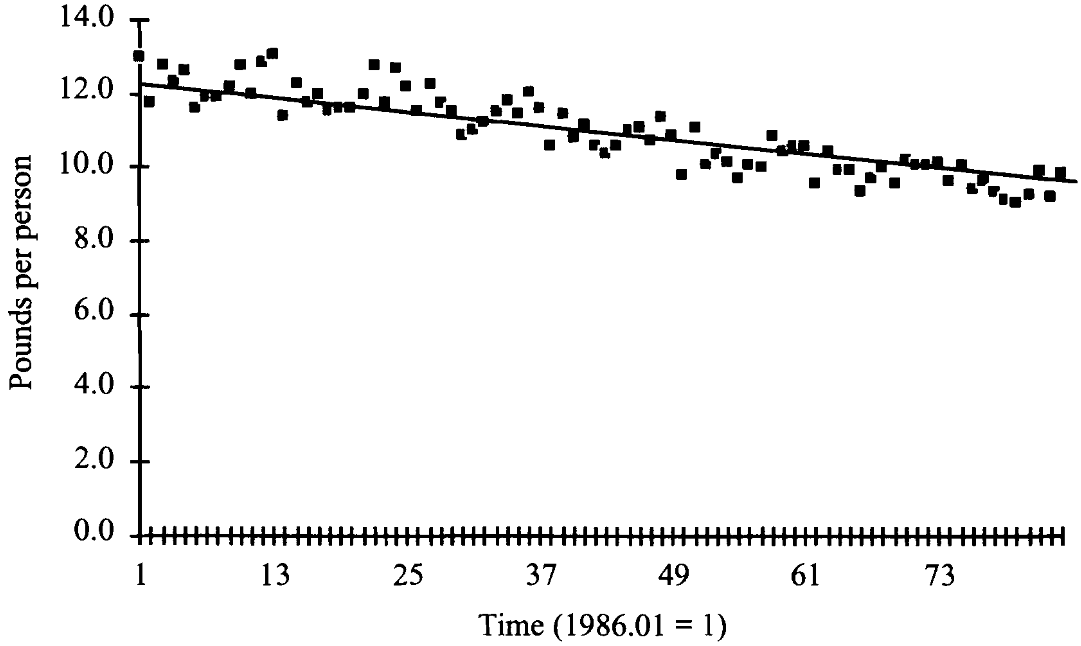

Figure 1. Per capita whole milk demand in New York City, 1986.01 - 1992.12.

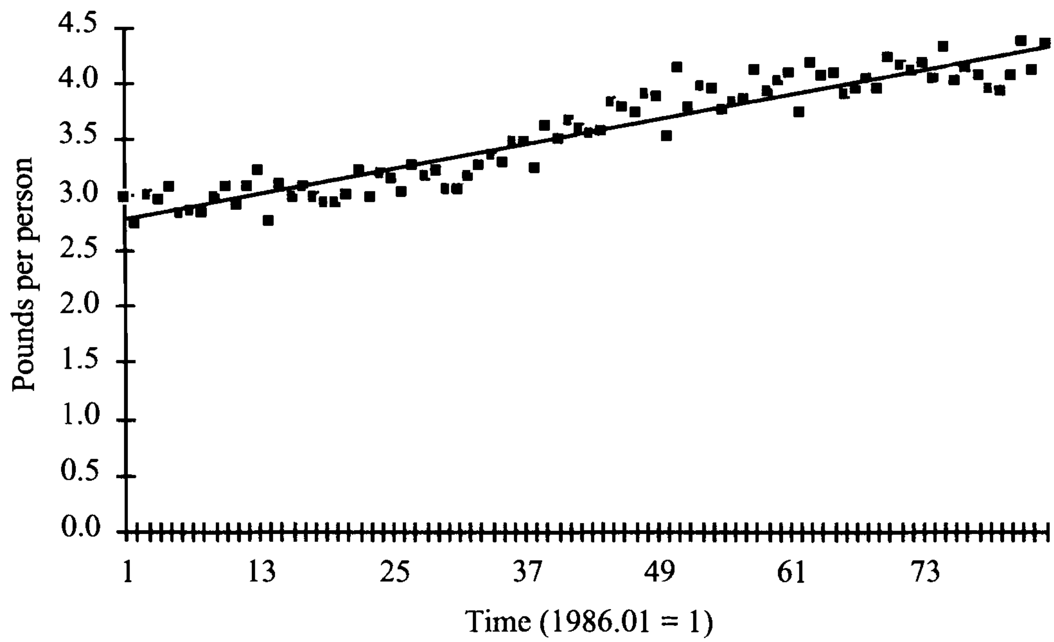

Figure 2. Per capita lowfat milk demand in New York City, 1986.01 - 1992.12.

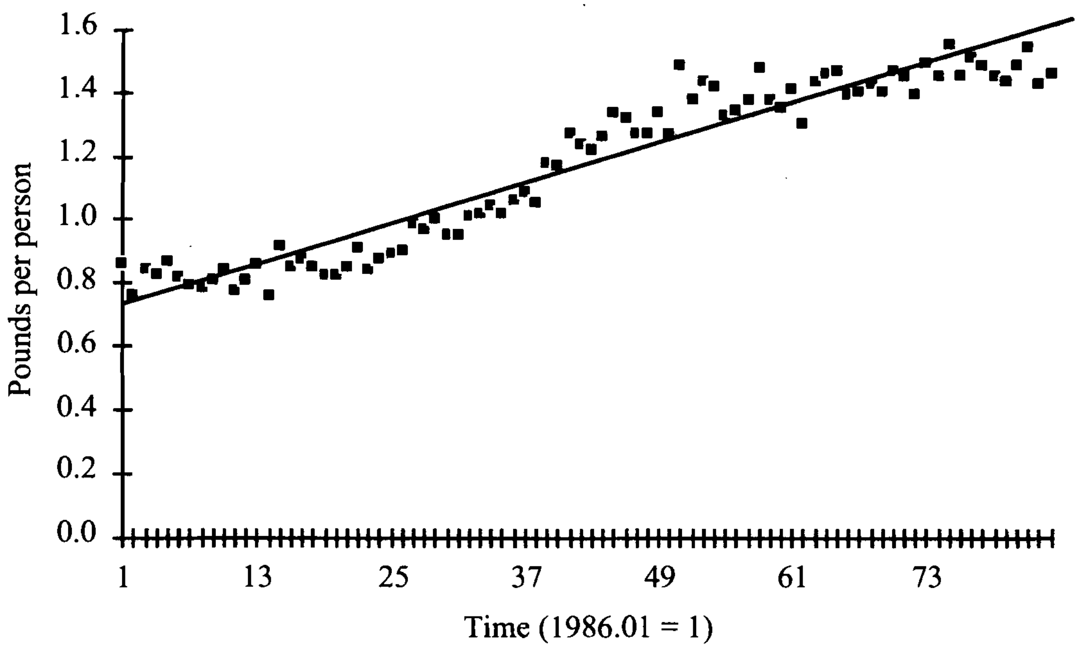

Figure 3. Per capita skim milk demand in New York City, 1986.01 - 1992.12.

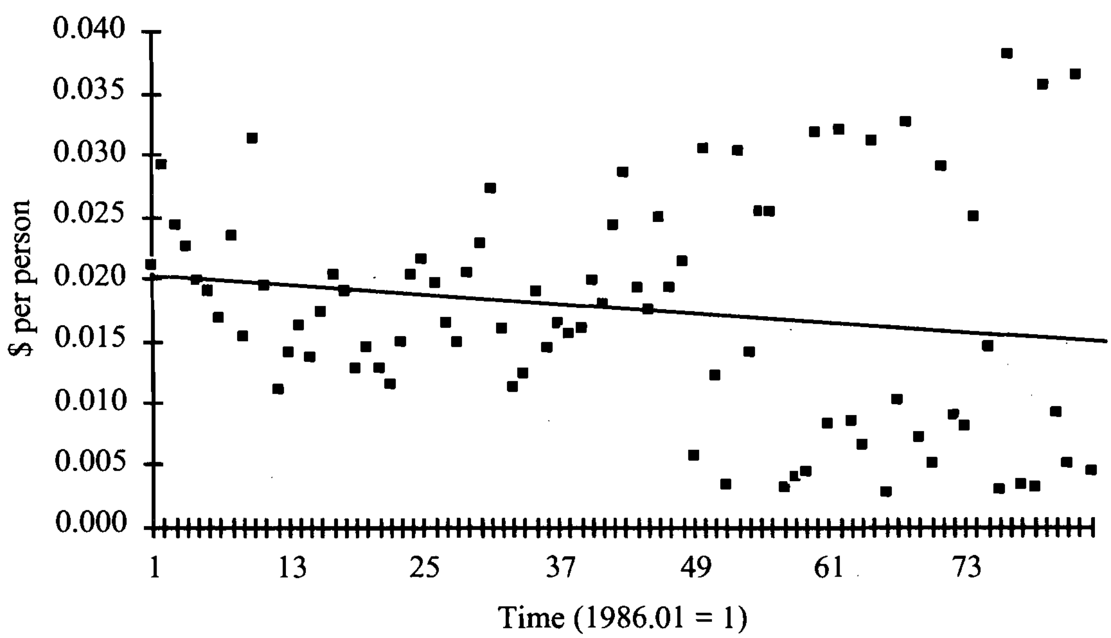

Figure 4. Per capita generic fluid milk advertising in New York City, 1986.01 - 1992.12.

Table 1. Estimated Whole Milk Demand Equation.

Variable	Estimated Coefficient	t-ratio
Constant	0.008	1.57
ln (Deflated Whole Milk Price)	-0.051	-0.21
ln (Deflated Lowfat Milk Price)	0.244	1.04
ln (Deflated Orange Juice Price)	0.209	2.04
ln (Deflated Per Capita Income)	0.915	11.61
ln (Health Index)$_t$	-0.036	-0.32
ln (Health Index)$_{t-1}$	-0.054	-0.55
ln (Health Index)$_{t-2}$	-0.073	-0.75
ln (Health Index)$_{t-3}$	-0.091	-0.92
ln (Health Index)$_{t-4}$	-0.110	-1.09
ln (Health Index)$_{t-5}$	-0.129	-1.30
ln (Health Index)$_{t-6}$	-0.148	-1.57
ln (Health Index)$_{t-7}$	-0.168	-1.89
ln (Health Index)$_{t-8}$	-0.188	-2.08
ln (Health Index)$_{t-9}$	-0.208	-1.94
Sum of Lagged Health Index Coefficients	-1.204	-1.50
ln (Deflated Generic Milk Advertising Expenditures)$_t$	0.002	0.32
ln (Deflated Generic Milk Advertising Expenditures)$_{t-1}$	0.004	0.48
ln (Deflated Generic Milk Advertising Expenditures)$_{t-2}$	0.008	0.66
ln (Deflated Generic Milk Advertising Expenditures)$_{t-3}$	0.010	0.86
ln (Deflated Generic Milk Advertising Expenditures)$_{t-4}$	0.013	1.05
ln (Deflated Generic Milk Advertising Expenditures)$_{t-5}$	0.015	1.23
ln (Deflated Generic Milk Advertising Expenditures)$_{t-6}$	0.017	1.36
ln (Deflated Generic Milk Advertising Expenditures)$_{t-7}$	0.018	1.45
ln (Deflated Generic Milk Advertising Expenditures)$_{t-8}$	0.018	1.49
ln (Deflated Generic Milk Advertising Expenditures)$_{t-9}$	0.016	1.50
ln (Deflated Generic Milk Advertising Expenditures)$_{t-10}$	0.013	1.48
ln (Deflated Generic Milk Advertising Expenditures)$_{t-11}$	0.008	1.46
Sum of Lagged Advertising Coefficients	0.140	1.30
Quarter 1 Dummy Variable	-0.020	-2.07
Quarter 2 Dummy Variable	-0.022	-2.24
Adjusted R^2	0.691	
Durbin-Watson	2.425	
F-Statistic for Significance of Skim Milk Price and Quarter 3 Dummy Variable	1.299	

to zero at the 10% level.[4] Then, the lag length for the health index was determined following the same procedure.

The Regression Results

The statistical results for the three demand equations are presented in Tables 1, 2 and 3. The final model specification was achieved after dropping from the original model those variables that had t-values less than one in absolute value and/or signs inconsistent with prior expectations. For each fluid milk product, the joint null hypothesis that the coefficients on the deleted variables are equal to zero was tested using an F-test. The value of the F-statistic for each product is reported at the bottom of each table. The final model for whole milk demand did not include the retail skim milk price and the intercept dummy variable for the third quarter. The final model for lowfat milk demand also did not include the retail skim milk price and none of the intercept quarterly dummy variables. The final model for skim milk did not include the retail whole milk price. The adjusted coefficients

[4]For generic milk advertising expenditures, a one-sided t-test was used, based on the prior expectation that the impact of this variable on sales is nonnegative. Similarly, a nonpositive effect of the health index on whole milk sales was expected, and, therefore a one-sided t-test was used to select the lag length for this variable.

Table 2. Estimated Lowfat Milk Demand Equation.

Variable	Estimated Coefficient	t-ratio
Constant	0.008	1.82
ln (Deflated Lowfat Milk Price)	-0.110	-0.32
ln (Deflated Whole Milk Price)	0.386	1.73
ln (Deflated Orange Juice Price)	0.204	1.89
ln (Deflated Per Capita Income)	0.993	11.77
ln (Health Index)$_t$	-0.083	-0.65
ln (Health Index)$_{t-1}$	-0.101	-0.96
ln (Health Index)$_{t-2}$	-0.119	-1.22
ln (Health Index)$_{t-3}$	-0.136	-1.39
ln (Health Index)$_{t-4}$	-0.153	-1.54
ln (Health Index)$_{t-5}$	-0.168	-1.72
ln (Health Index)$_{t-6}$	-0.184	-1.96
ln (Health Index)$_{t-7}$	-0.198	-2.21
ln (Health Index)$_{t-8}$	-0.212	-2.28
ln (Health Index)$_{t-9}$	-0.225	-2.00
Sum of Lagged Health Index Coefficients	-1.578	-1.95
ln (Deflated Generic Milk Advertising Expenditures)$_t$	0.002	0.36
ln (Deflated Generic Milk Advertising Expenditures)$_{t-1}$	0.005	0.53
ln (Deflated Generic Milk Advertising Expenditures)$_{t-2}$	0.008	0.74
ln (Deflated Generic Milk Advertising Expenditures)$_{t-3}$	0.012	0.95
ln (Deflated Generic Milk Advertising Expenditures)$_{t-4}$	0.015	1.17
ln (Deflated Generic Milk Advertising Expenditures)$_{t-5}$	0.018	1.36
ln (Deflated Generic Milk Advertising Expenditures)$_{t-6}$	0.021	1.50
ln (Deflated Generic Milk Advertising Expenditures)$_{t-7}$	0.022	1.58
ln (Deflated Generic Milk Advertising Expenditures)$_{t-8}$	0.022	1.62
ln (Deflated Generic Milk Advertising Expenditures)$_{t-9}$	0.0120	1.63
ln (Deflated Generic Milk Advertising Expenditures)$_{t-10}$	0.0160	1.61
ln (Deflated Generic Milk Advertising Expenditures)$_{t-11}$	0.009	1.56
Sum of Lagged Advertising Coefficients	0.168	1.43
Adjusted R^2	0.670	
Durbin-Watson	2.382	
F-Statistic for Significance of Skim Milk Price and Quarterly Dummy Variables	0.735	

of determination for the estimated whole, lowfat, and skim milk demand functions were .69, .67, and .60, respectively.

Not surprisingly, all of the estimated own price elasticities were inelastic, -0.05 (whole milk), -0.11 (lowfat milk), and -0.33 (skim milk). In fact, only the skim milk own price elasticity was significant at the 10% level. The skim milk price elasticity was consistent with previous studies of New York City own fluid milk price elasticities, e.g., -0.32 (Kinnucan, Chang, and Venkateswaran), -0.29 (Liu and Forker, 1988), and -0.18 (Liu and Forker, 1990). Alternatively, the whole and lowfat price elasticities were similar to a previous study of New York City by Kinnucan (1986), who estimated an own fluid price elasticity of -0.095. The price of substitutes had a more significant impact on the demand for whole and lowfat milk than the own price. For instance, both the retail lowfat milk and orange juice price had larger elasticities than the own price in the whole milk demand equation. A similar result holds for the lowfat milk demand equation. However, the own price elasticity of demand for skim milk was larger than the two substitute prices in the skim milk demand equation. Deflated per capita income was highly significant in all three equations, and ranged in value from .86 to .99. The estimated income elasticities were twice as high as previous estimates for fluid milk demand in New York City, e.g., 0.42 (Kinnucan, 1986), 0.41 (Kinnucan, Chang, and Venkateswaran), 0.48 (Liu and Forker, 1988), and 0.36 (Liu and Forker, 1990). The health concern index was significant in the whole and lowfat demand equations, but not significant in the skim milk demand

Table 3. Estimated Skim Milk Demand Equation.

Variable	Estimated Coefficient	t-ratio
Constant	0.018	-1.92
ln (Deflated Skim Milk Price)	-0.330	-1.35
ln (Deflated Lowfat Milk Price)	0.102	0.38
ln (Deflated Orange Juice Price)	0.215	1.82
ln (Deflated Per Capita Income)	0.856	8.94
ln (Health Index)$_t$	0.097	0.71
ln (Health Index)$_{t-1}$	0.066	0.57
ln (Health Index)$_{t-2}$	0.043	0.39
ln (Health Index)$_{t-3}$	0.028	0.25
ln (Health Index)$_{t-4}$	0.020	0.18
ln (Health Index)$_{t-5}$	0.021	0.18
ln (Health Index)$_{t-6}$	0.030	0.25
ln (Health Index)$_{t-7}$	0.046	0.39
ln (Health Index)$_{t-8}$	0.071	0.62
ln (Health Index)$_{t-9}$	0.103	0.96
ln (Health Index)$_{t-10}$	0.143	1.39
ln (Health Index)$_{t-11}$	0.192	1.79
ln (Health Index)$_{t-12}$	0.248	2.02
Sum of Lagged Health Index Coefficients	1.106	0.93
ln (Deflated Generic Milk Advertising Expenditures)$_t$	-0.006	-1.07
ln (Deflated Generic Milk Advertising Expenditures)$_{t-1}$	-0.009	-0.87
ln (Deflated Generic Milk Advertising Expenditures)$_{t-2}$	-0.008	-0.61
ln (Deflated Generic Milk Advertising Expenditures)$_{t-3}$	-0.004	-0.30
ln (Deflated Generic Milk Advertising Expenditures)$_{t-4}$	0.001	0.06
ln (Deflated Generic Milk Advertising Expenditures)$_{t-5}$	0.007	0.44
ln (Deflated Generic Milk Advertising Expenditures)$_{t-6}$	0.013	0.83
ln (Deflated Generic Milk Advertising Expenditures)$_{t-7}$	0.018	1.17
ln (Deflated Generic Milk Advertising Expenditures)$_{t-8}$	0.021	1.46
ln (Deflated Generic Milk Advertising Expenditures)$_{t-9}$	0.021	1.68
ln (Deflated Generic Milk Advertising Expenditures)$_{t-10}$	0.019	1.84
ln (Deflated Generic Milk Advertising Expenditures)$_{t-11}$	0.012	1.96
Sum of Lagged Advertising Coefficients	0.083	0.64
Quarter 1 Dummy Variable	0.056	4.48
Quarter 2 Dummy Variable	0.017	1.34
Quarter 3 Dummy Variable	0.023	1.74
Adjusted R^2	0.600	
Durbin-Watson	2.166	
F-Statistic for Significance of Whole Milk Price	0.373	

equation. The long run elasticities for the health index were -1.2, -1.6, and 1.1 for whole, lowfat, and skim milk, respectively, indicating that health concerns about fat have a negative effect on whole and lowfat milk demand and positive (but not statistically significant) impact on skim milk demand.

In the final estimated equations, generic fluid advertising was lagged eleven months, indicating an advertising carry-over effect of almost one year. The long run generic advertising elasticities (sum of all coefficients) were 0.14, 0.17, and 0.08 for whole, lowfat, and skim milk, respectively. The advertising elasticities were higher than previous estimates for sales responsiveness to generic fluid milk advertising in New York City, e.g., 0.051 (Kinnucan, 1986), 0.016 (Kinnucan, Chang, and Venkateswaran), 0.002 (Liu and Forker, 1988), and 0.03 (Liu and Forker, 1990). Based on a t-test, the long run generic advertising elasticity was significant at the 10% level for whole and lowfat milk, but not significant for skim milk. Thus, the results indicate that existing and previous generic fluid milk advertising has had a positive impact on whole and lowfat milk demand, but has had no significant impact on skim milk demand in the New York City Market.

Policy Implications

There are several policy implications of these results. First, the results indicate that generic fluid advertising in New York City has been more effective in increasing whole and low fat milk demand compared with skim milk demand. This suggests that the message of current and past fluid milk advertising campaigns may have been implicitly targeted to actual or potential consumers of whole and lowfat milk rather than skim milk. Recall that current and past generic fluid milk advertising did not differentiated among the three fluid milk products. An alternative to the current advertising strategy of no differentiation among the three fluid milk products might be to target actual or potential consumers of whole and lowfat milk since they are more responsive to past and present generic advertising.

Second, given changes in consumption patterns towards lower fat products, there might be some advantage to focusing on promoting lowfat milk products. The results of this study indicate that lowfat milk drinkers (in New York City) respond positively to milk advertising. Hence, targeting this group of milk consumers would appear to be a good way of increasing overall milk demand. The results also indicate that targeting skim milk consumers might be a gamble. This group of milk drinkers have been the least responsive to previous and current advertising. As was argued above, the advertising message would have to be altered under a skim milk advertising campaign.

Third, since the sales response to generic fluid advertising among the three products were found to be different, future research on generic fluid milk advertising should disaggregate milk products accordingly whenever possible. While generic fluid advertising did not have a significantly positive impact on skim milk demand in the New York City market, this result may be different in other markets. Hence, it would be useful to apply this empirical approach to other markets to determine whether New York City is unique or representative of other locations. Certainly the results from other markets should be obtained before making any generalizations to larger geographic locations.

Summary

Previous research on the effectiveness of generic fluid milk advertising has not identified the differential impacts of advertising on specific products, i.e., whole, lowfat, and skim milk. However, since consumption patterns for these products are different, useful information is lost in advertising evaluation studies when looking only at the aggregate impact on the fluid milk category. Consequently, the purpose of this study was to determine whether there is a statistical difference in sales responsiveness of advertising among whole, lowfat, and skim milk consumers. A case study for New York City was presented using monthly time series demand data from 1986 through 1992. Separate demand functions were estimated for whole, lowfat, and skim milk when generic fluid milk advertising expenditures were used as one of the explanatory variables.

The results indicated that the long run sales responsiveness to generic milk advertising is 0.14, 0.17, and 0.08 for whole, lowfat, and skim milk, respectively. These are higher than previous estimates for generic fluid milk advertising elasticities in New York City. Based on a t-test, the long run sales response to generic advertising was found to be significant at the 10% level for whole and lowfat milk, but not significant for skim milk. Thus, it was concluded that generic fluid milk advertising, as currently structured, has had a positive impact on whole and lowfat milk demand, but little or no impact on skim milk demand in New York City.

There are several implications of these results. First, current and past message of fluid milk advertising campaigns is explicitly influencing actual and potential whole and lowfat milk drinkers rather than skim milk consumers. Therefore, under campaigns that do not differentiate among the three main fluid milk products, it would be better to target actual or potential consumers of whole and lowfat milk rather than skim milk drinkers. Second, changing advertising strategies to promote lowfat milk may lead to an increase in overall consumption, but the same might not be true for focusing advertising on skim milk. Thus, any attempt to influence skim milk demand would require a change in the current message. Third, since the sales response to milk advertising among the three products have been found to be different, future research on generic fluid milk advertising should study the impact on each fluid milk product separately. Finally, it would be useful to apply this approach to other U.S. markets to determine whether similar results would be found, or whether New York City is unique in its response to generic fluid milk advertising.

References

Banerjee, A. J.J. Dolado, J.W. Galbraith, and D.F. Hendry. Co-Integration, Error-Correction, and the Econometric Analysis of Non-Stationary Data. New York: Oxford University Press, 1993.

Davidson, R. and J.G. Mackinnon. Estimation and Inferences in Econometrics. New York: Oxford University Press, 1993.

Forker, O.D. and H.W. Kinnucan. "Econometric Measurement of Generic Advertising." International Dairy Federation Special Issue No. 9202. Brussels, Belgium, 1991.

Fuller, W.A. Introduction to Statistical Time Series. New York: John Wiley and Sons, 1976.

Kaiser, H.M., O.D. Forker, J. Lenz, and C.H. Sun. "Evaluating Generic Dairy Advertising Impacts on Retail, Wholesale, and Farm Milk Markets." Journal of Agricultural Economics Research. 44(1994):3-17.

Kinnucan, H.W., H.S. Chang, and M. Venkateswaran. "Generic Advertising Wearout." Review of Marketing and Agricultural Economics. 61(1993):401-15.

Kinnucan, H.W. "Effect of Canadian Advertising on Milk Demand: The Case of the Buffalo, New York Market." Canadian Journal of Agricultural Economics. 35(1987):181-96.

Kinnucan, H.W. "Demographic versus Media Advertising Effects on Milk Demand: The Case of the New York City Market." Northeastern Journal of Agricultural Economics. 15(1986):66-74.

Liu, D.J. and O.D. Forker. "Generic Fluid Milk Advertising, Demand Expansion, and Supply Response: The Case of New York City." American Journal of Agricultural Economics. 70(1988):229-36.

Liu, D.J. and O.D. Forker. "Optimal Control of Generic Fluid Milk Advertising Expenditures." American Journal of Agricultural Economics. 72(1990):1047-55.

Liu, D.J., H.M. Kaiser, O.D. Forker, and T.D. Mount. "An Economic Model of the U.S. Generic Dairy Advertising Program Using an Industry Model." Northeastern Journal of Agricultural Economics 19(1990):37-48.

Thompson, S.R. "The Response of Milk Sales to Generic Advertising and Producer Returns in the Rochester, New York Market." A.E. Staff Paper 79-26, Department of Agricultural Economics, Cornell University, Ithaca, New York, 1979.

Thompson, S.R. "Sales Response to Generic Promotion Efforts and Some Implications of Milk Advertising on Economic Surplus." Journal of the Northeastern Agricultural Economics Council. 3(1974):78-90.

Thompson, S.R. and D.A. Eiler. "Producer Returns from Increased Milk Advertising." American Journal of Agricultural Economics. 57(1975):505-08.

U.S. Department of Agriculture. USDA Report to Congress on the Dairy Promotion Program. 1985-94.

Ward, R.W. and B.L. Dixon. "Effectiveness of Fluid Milk Advertising Since the Dairy Tobacco Adjustment Act of 1983." American Journal of Agricultural Economics. 71(1989):730-40.

Ward, R.W. Health Index on Dietary Concerns over Fat. Department of Agricultural Economics, University of Florida, Unpublished, 1995.

OTHER A.R.M.E. RESEARCH BULLETINS

No. 94-03	The Geographic Structure of Milk Hauling Cost and Efficiencies in New York State	Eric Erba James Pratt
No. 94-04	Price Transmission Theory and Applications to Agroindustry: An Annotated Bibliography	Lisa A. Schwartz Lois Schertz Willett
No. 94-05	Decision Making in Membership Organizations: A Study of Fourteen U.S. Cooperatives	Brian M. Henehan Bruce L. Anderson
No. 94-06	Identifying a Reduced Set of Salient Attributes that Influence Consumers' Choice Among Whole, Low-Fat, and Skim Milk for Beverage Use	Heiko Miles Steven J. Schwager John E. Lenz
No. 94-07	Dairy Farm Management Business Summary New York State 1993	Stuart F. Smith Wayne A. Knoblauch Linda D. Putnam
No. 94-08	The Effects of Time-of-Use Electricity Rates on New York Dairy Farms	Mark Schenkel Richard N. Boisvert
No. 95-01	Supermarket Bakery Consumers Attitudes, Preferences, Behaviors	Edward W. McLaughlin Gerard Hawkes Kristen Park Debra Perosio
No. 95-02	The Economics of Converting Conventionally Managed Eastern Vineyards to Organic Management Practices	Gerald B. White
No. 95-03	Dairy Farm Management Business Summary New York State 1994	Stuart F. Smith Wayne A. Knoblauch Linda D. Putnam